Processes and feedbacks associated with iceberg calving and subaqueous terminus morphology, Tasman/Haupapa Glacier, New Zealand

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Calving is an important process influencing the mass balance of a glacier.
The calving rate and magnitude of iceberg calving can be influenced by the presence of subaqueous ice ramps. Some calving glaciers form subaqueous ice ramps or 'ice feet' due in part to differences in the rates of subaerial and subaqueous calving. Spatial and temporal variation of these subaqueous features indicate that other processes also exert control. A relationship between velocity and calving was identified from this study. Velocity was found to influence calving whereby an increase in surface velocity would result in higher longitudinal strain rates and crevasse propagation that would lead to calving. The margins of the terminus with slower surface velocity and higher lateral drag, had less crevasse propagation and were considered more stable, these areas typically had the longest ice ramps. The central part of the ice cliff with higher surface velocity was more prone to crevassing. Ice ramps in these areas were typically steeper and shorter. The distribution of ramp lengths from 2013 – 2018 are commonly between 40 – 120 m in length (n=17) with the next largest group (n=12) between 120 – 200 m, only three ramps have been identified as greater than 200 m over the five-year survey time. From 2013-2018 a limited number of ice ramps exceeded 200 m in length, suggesting that ice ramps greater that 200 m are highly prone to buoyant calving. Findings to date indicate the primary driver of subaqueous ice ramp formation is the faster aerial calving rate over subaqueous calving. Spatial and temporal variation in velocity, lake limnology and subglacial hydrology also drive the formation and calving of subaqueous morphology but on a lesser scale than that of aerial calving.